

LANGERMANNIA BICOLOR (LEV.) DEMOULIN & DRING

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SUMMARY

American specimens identified as Lanopila bicolor and Lanopila wahlbergii are compared with material from Africa and with the isotype of Bovista bicolor Lev. from India. It was found that they belong to the same species.

In the process of this study, the cells called mycoscleroids by Homrich and Wright (1973), were found and interpreted following the opinion of Dr. R. Singer, as chlamydospores.

Langermannia bicolor has in tropical America a very wide and irregular distribution ranging from Mexico and the West Indies to Argentina with northern and southern limits reaching the warm-temperate zones. Lately it has been collected in the southwestern part of the United States and southern Florida.

The first material of this species was collected in India and identified by Leveille (1846) as Bovista bicolor. This material has been missing for a long time (seen last by Lloyd in Paris in 1902), only one isotype is in Berkeley's collection at Kew. This specimen must be considered as the lectotype of Langermannia bicolor.

Years later Fries (1849) created the genus Lanopila based on material collected in Natal, South Africa by Wahlberg and named it Lanopila wahlbergii but the type material of this species is missing also.

Later Reichardt (1870) proposed the name Lasiosphaera fenzlii for a specimen from Nicobar Island in India. This name was recognized by Hollos (1904) and Smarda (1958) and Dissing and Lange (1962) identified material collected by Vanderist and Gossens-Fontana in Congo as Langermannia fenzlii (Reich.) Kreisel but Demoulin and Dring (1975) studied the type material of Lasiosphaera fenzlii Reich from Nicobar Island and stated that the spores and capillitium are similar to the African material of Langermannia wahlbergii (Fr.) Dring.

Patouillard (1899) named some material from South America Lanopila bicolor considering that it agrees with Bovista bicolor of Leveille from India and has been known in America as L. bicolor or L. wahlbergii. There have always been doubts about the taxonomic position of the American material and of its identity with the material collected in Africa as Lanopila wahlbergii and in Asia as Lasiosphaera fenzlii and Bovista bicolor.

Spegazzini (1881-1891) identified two species from Argentina and Lanopila argentina and Lanopila guaranitica which are now considered synonymous with Langermannia bicolor.

Lloyd (1904) after seeing the material of Leveille from India (Bovista bicolor Lev.) in Paris, was the first to call attention to the similarity of the materials from America, Africa and Asia and called them Lanopila bicolor. In 1923 he returned to the name Lanopila wahlbergii and named two new species, L. capensis from South Africa and L. yuconensis from Canada. The last two species are included in the list of Species Excludendae.

R. E. Fries (1909) recognized Lanopila bicolor (Lev.) Pat. and created a new species, L. pigmaea from Bolivia, which is a Bovista.

Verwoerd (1925) recognized Lanopila wahlbergii, Lanopila capensis and named a new species Lanopila radloffiana. The last is included in the list of Species Excludendae.

Swoboda (1937) made an extensive anatomical study of some specimens from Texas which he called Lanopila wahlbergii Fries. He claims that this material was so identified by Alexander H. Smith. It is however another fungus, as Dr. Smith clarified in a personal communication to Homrich and Wright (1973).

Dring (1964) proposed to include Lanopila and Lasiosphaera in the old genus Langermannia, recognizing two species, L. gigantea from the temperate zones, as the type, and L. wahlbergii from Africa. He considers that all the material collected in Africa, belong to the Frie's species since even in the original description the spores are not described as spinose.

Kreisel (1962) recognized Langermannia fenizlii (Reich.) Kreisel as a nov. comb. based on Lasiosphaera fenizlii Reich. but in 1967 in the discussion of the Calvatia-Complex he included Lanopila and Lasiosphaera in the genus Langermannia, with the following species L. wahlbergii (Fr.) Dring, L. pachyderma (Peck) Kreisel and L. gigantea (Batsch ex Pers.) Rostk. Langermannia pachyderma is here included in Species Excludendae as Gastropila fragilis (Lev.) Homrich and Wright.

Eckblad (1971) considers the spores of Lanopila bicolor to be fairly close to those of the group of Bovista, Calvatia, Disciseda and Lycoperdon.

Homrich and Wright (1973) after making an intensive study of the peridium of American material, which they called Lanopila bicolor, retaining the generic name Lanopila instead of Langermannia "until more conclusive evidence is presented that their (respective) type species are congeneric." These authors stated that Lanopila is monotypic and belongs in the Lycoperdales, and maintain that the differences observed by others between Lanopila bicolor from

America and Asia and *Lanopila wahlbergii* from Africa, are in the range of "specific variation."

Studying material referred to *Lanopila* from America, Africa and Asia and comparing it with the isotype of *Lanopila bicolor* (Lev.) Pat. (*Bovista bicolor* Lev.) from India at Kew, I found that in the material with the epithets, *bicolor*, *wahlbergii* and *fenzlii*, the exoperidium is formed of two or more layers of appressed irregularly polygonal cells (as epithelial cells) 3 x 4 u in diameter, light brown or yellowish. Underneath the exoperidium I found that some of the cells called mycosclereids .) by Homrich and Wright (1973). When consulted, Dr. Singer stated that they are chlamydospores, comparable to those present in *Squamanita schreieri* (Imbach) Imbach as demonstrated by Singer and Clemencón (1972). These cells are round 12 x 15 u in diameter, smooth and with a cyanophilous wall. The endoperidium is formed of large brown ramified sterile filaments that form a layer easily separated from the rest of the gleba. The basidiospores are round with verrucose protuberances, dark-yellow, approximately 6 u in diameter (including ornamentation). The capillitium is ramified and septate and separating at the septa. Filaments 4 u in diameter, brown with round pores.

Treated with Melzer solution the exoperidial cells were separated from each other but no color change was produced; nor were the spores, capillitium and chlamydospores affected by this treatment (inamyloid).

NH<sub>4</sub>OH did not produce any change in the aspect of the exoperidium, capillitium or spores.

With cotton blue the cells of the exoperidium were freed and absorbed the blue color (cyanophilous reaction). Spores and capillitium were acyanophilous. The chlamydospores were strongly cyanophilous in the periphery and with a cyanophilous inner wall.

The exoperidium of these species is similar to the exoperidium of *Langermannia gigantea* (material from Wisconsin, (F)).

The spores which are very rugose, verrucose as previously stated in *Langermannia bicolor* and *Langermannia wahlbergii* are almost smooth in *Langermannia gigantea*.

Following the opinion of Dring (1964) I adopt the generic name *Langermannia* for the species known as *Lanopila bicolor* in America.

The specific name *bicolor* used by Leveille in 1846 (*Bovista bicolor* Lev.) for the material collected by Polydore Roux in Bombay, India is the oldest name used for this species and will

.) Our interpretation of these "Mycosclereids" in the sense of Homrich and Wright does not affect the original definition and illustration of mycosclereids in *Tulostoma* (Wright 1955).

take precedence over wahlbergii, the name used by R. M. Fries in 1849 for the material collected by Wahlberg in Natal, South Africa and fenzlii, the name used by Reichardt in 1870 for the material from Nicobar, Island, India.

After comparing the isotype material of Bovista bicolor Lev. from India (K) with the material from America and Africa I arrived at the conclusion that all belong to the same species. Since the type of Lanopila wahlbergii Fries is missing I used for comparison with American and African material the specimen from Durban, South Africa collected by P. van der Bijl and identified by Lloyd as Lanopila wahlbergii, Lloyd #354, Lloyd Cat. 53094. There is an annotation by Zeller as L. bicolor.

All the other species identified as Lanopila or Lasiosphaera except the type Lasiosphaera (Pers.) Smarda (= Langermannia gigantea (Pers.) Rostk.) are synonyms of Langermannia bicolor or belong to other genera such as Calvatia, Bovista, Lycoperdon, etc.

I agree therefore with Demoulin & Dring (1975) who, with reservation, proposed to adopt the name Langermannia bicolor (Lev.) Demoulin & Dring for the material collected in India. Since I am convinced that the African and American material are conspecific Langermannia bicolor is then the correct binomial to be used for all materials described below.

#### LANGERMANNIA BICOLOR (Lev.) DEMOULIN & DRING

Bovista bicolor Leveille, Champignon du Museum de Paris. Ann. Sci. Nat. Bot. Ser. 3(5): 162. 1846.

Lanopila wahlbergii Fries, Fungi Natalensis. Kongl. Vetensk. Acad. Handl. 1848. 15. 1848.

Lasiosphaera fenzlii Reichardt in Reise seiner Majestat Fregatte Novara um die Erde 1: 135. 1870.

Lanopila argentina Spegazzini. Fungi Argentini. Anales Soc. Ci. Argent. 12: 248. 1881.

Lanopila guaranitica Spegazzini. Fungi Guaranitici Nonnulli Novi Vel Critici. Revista Argen. Hist. Nat. 1(3): 169. 1891.

Lanopila bicolor (Lev.) Patouillard. Champignons de la Guadalupe. Bull. Soc. Myc. Fr. 15: 203. 1899.

Langermannia wahlbergii (Fr.) Dring. Gasteromycetes of West Tropical Africa. C. M. I. Mycol. Papers No. 98: 46. 1964.

Basidiocarps globose to depressed-globose, 3-10 cm in diameter, without a basal rhizomorph, pinched into a basal point of attachment from which it breaks away at maturity. Peridium formed by three layers, the outer two apparently forming the exoperidium, which is very thin, smooth and sometimes brilliant, formed by periclinally disposed hyphae, easily falling off in flakes at first orange pinkish turning to brown when mature and dry; the endoperidium 20-30  $\mu$  thick, elastic, smooth, almost chamois-like to the touch, light cinnamon, remaining after most of the exoperi-

dium has fallen off but afterwards also breaking off in patches and eventually disappearing. On the upper limit of the endoperidium there are some round cells of 12-15  $\mu$  in diameter with an intense cyanophilous wall interpreted as chlamydospores (mycoscleroids of Homrich and Wright (1973). Gleba light brown, formed by the capitial threads intertwined plus the spores, and appearing as a compact, very persistent mass of wool. Subgleba absent. Spores globose, light brown, some with a short pedicel, closely warted, 5.5-7.5  $\mu$  in diameter, including the ornamentation; the warts arise from a thick wall. (Eckblad (1971) has shown with SEM that the spores are covered by high warts like cylindric cogs arranged in groups and with a flattened apex). Capillitium composed of densely interwoven, light brown 3-4  $\mu$  in diameter, sparsely branched hyphae, with all the branches of equal diameter but the ends of the threads distinctly tapering, easily isolated, narrower at the frequent septa wall with round pore-like perforation.

Type collection. Polydore Roux, (isotype Herb. Berkeley (K) Bombay, India.

Habitat: On the ground, in open and shaded sites or in sand dunes along the seashore, with scant vegetation; free at maturity.

Distribution: Africa, south of the Sahara; tropical Asia; South America; West Indies; Southern North America.

CENTRAL AMERICA. MEXICO. Chihuahua, Sanderson 5408, 1954, Lloyd Cat. 53085 as Lanopila bicolor (BPI). NICARAGUA. No other information, Smith s.n. ex Ellis collection as Lanopila rubra, Bovista laterita Berk. and Lycoperdon rubrum (NYBG); Smith 235 as Bovista laterita Berk. (NYBG). WEST INDIES. INDES. No other information. No collector. Herb. Patouillard as Lanopila bicolor (Lev.) (FH). CUBA. Wright 925 Fungi cubenses Wrightianii as Bovista tosta B & C. (FH). JAMAICA. Kingston; Hope Garden, Harris s.n. 3-13-1910, Lloyd 07015 and Lloyd Cat. 53807, as Lanopila bicolor (BPI) (NYBG). PUERTO RICO. San Juan, Earle 73 as Lycoperdon sp. (NYBG). GUADALUPE. Base Terre, Duss 92, Herb. Patouillard as Lanopila bicolor (Lev.) (Pat. and Lycoperdon (BPI). ST. KITTS. Lunt s.n., Herb. Patouillard as Lanopila bicolor (Lev.) Pat. Lloyd 03175 (FH) (NYBG), Lloyd Cat. 53089 and 30989 (BPI). MONSERRAT. Plymouth, Shaffer 873, as Bovista sp. (NYBG). SOUTH AMERICA. No other information. Lloyd 6343, Herb. Patouillard as Lanopila bicolor (Lev.) Pat. (FH). VENEZUELA. No other information, Lewis s.n. (by Squibb Institute) as Lanopila wahlbergii R. E. Fries (NYGB); Guarico, Calabozo. Estacion Biologica Llanos, Tamayo 4316 as Lanopila bicolor (Lev.) Pat. (BPI). ECUADOR. Pichincha: San Nicolas, Lagerheim s.n. Lloyd 6343, Lloyd Cat. 30988 as Lanopila bicolor (FH); Quito, Mille s.n. Feb. 1919, Lloyd Cat. 50578, as Lanopila wahlbergii, is Bovista plumbea Pers. ex Pers. (BPI). BRAZIL. No other information. Rick s.n. Lloyd 03676, Lloyd Cat. 53092 as Lanopila bicolor (BPI); Rick s.n. Lloyd Cat. 53090 as Lanopila bicolor (BPI); Rick s.n. Lloyd 04020, Lloyd Cat. 53091 as Lanopila bicolor (BPI); Rick s.n. Lloyd 06233, Lloyd Cat. 53093 as Lanopila guaranitica ? (Note of Zeller as Lanopila bicolor (BPI); Bahia: Torrend s.n. Lloyd 726, Lloyd Cat. 14658 as

Lanopila wahlbergii (BPI): Rio Grande Sul: Sao Leopoldo, Rick s.n. 1931 (FH). PARAGUAY. No other information. Balanza s.n. Herb. Patouillard as Lanopila guaranitica Speg. (FH). NORTH AMERICA. UNITED STATES. Arizona: 7 miles North of Nogales, Long and Samberg s.n. Nov. 13, 1936, W. H. Long Herb (BPI); Santa Cruz River 10 miles from Nogales Long 8253, June 4, 1938, W. H. Long Herb. (BPI) (NYBG); Santa Cruz River 8 miles from Nogales, Long 8254, Nov. 10, 1938, W. H. Long Herb. (BPI); Florida: Southern Florida (in citrus grove), Weber and West s.n. Dec. 1949, as Bovista bicolor (Lev.) Pat. (BPI). AFRICA. ZAIRE (Belgian Congo). Kawai: Sankuru (Lusambo) Free State, Luja s.n. Jan. 1908, Lloyd Cat. 30990 as Lanopila bicolor (BPI). TANZANIA (Dutch Africa) Tanganyca, Amani, Braum 1949 Feb. 16, 1908, Lloyd Cat. 53080 as Lanopila bicolor. It is a mixed collection with Lycoperdon sp.. SOUTH AFRICA. No other locality, Duthie s.n. no date, Lloyd Cat. 19248 as Lanopila wahlbergii (BPI); Durban, Bijl s.n. 1919 ?, Lloyd Cat. 53094 as Lanopila wahlbergii. There is an annotation by Zeller as L. bicolor (BPI). ASIA. INDIA. Bombay: Polydore Roux s.n. No date of collection, Herb. Berkeley. Annotated "from the type locality," Isotype (K).

#### SPECIES EXCLUDENDAE

- Lanopila capensis Lloyd, Myc. Wright 7: 1177. 1923. Typus: Duthie 403, Lloyd Coll. No. 7567 (BPI). Locus typicus: Union of South Africa.
- Lanopila pygmaea R. E. Fries, Ark. Bot. 8 No. 11: 16-17. Tab. II. 6-9. 1909. Typus: Cotypus R. E. Fries 65a, Lloyd Coll. No. 32435. Locus typicus: Pampa Blanca, Jujuy, Argentina. It is Bovista pusilla (Batsch ex) Pers.
- Lanopila radloffiana Verwoerd, Annale Universiteit Stellenbosch 3: 25. 1925. Typus: Radloff (V. D. Byl 1439) (STE). Locus typicus: Winburg, O. V. S. Union of South Africa. It is Bovista.
- Lanopila stipitata (Berk.) De Toni in Saccardo Sylloge Fungorum 7: 95. 1888. Typus: Wright s.n. (Bovista stipitata Berk. North Amer. Fungi No. 330). (K). Locus typicus: Texas, U.S.A. It is Bovistella radicata (Dur. & Mont.) Pat.
- Lanopila tabacina (Sacc.) de Toni Saccardo Sylloge Fungorum 7: 95. 1888. Typus: Missing. Locus typicus: Canada. It is Bovista pila Berk. & Curt, cf. Lloyd Myc. Writ.: 117. 1902.
- Lanopila yuconensis Lloyd, Myc. Writ. 7: 1177. 1923. Typus: Sterling s.n. Lloyd Coll. No. 7566. (BPI). Locus typicus: Dawson, Yukon Terr. Canada. It is Bovista pusilla (Batsch ex) Persoon.
- Langermannia pachyderma (Peck) Kreisel, Die Lycoperdaceae der Deutschen Demokratischen Republik. Bibliotheca Mycologica Band 36: 120. 1962. as nov. comb. based on Lycoperdon pachyderma Peck. Bot. Gazette 7: 54. 1882. It is Gastropila fragilis (Lev.) Homrich & Wright.



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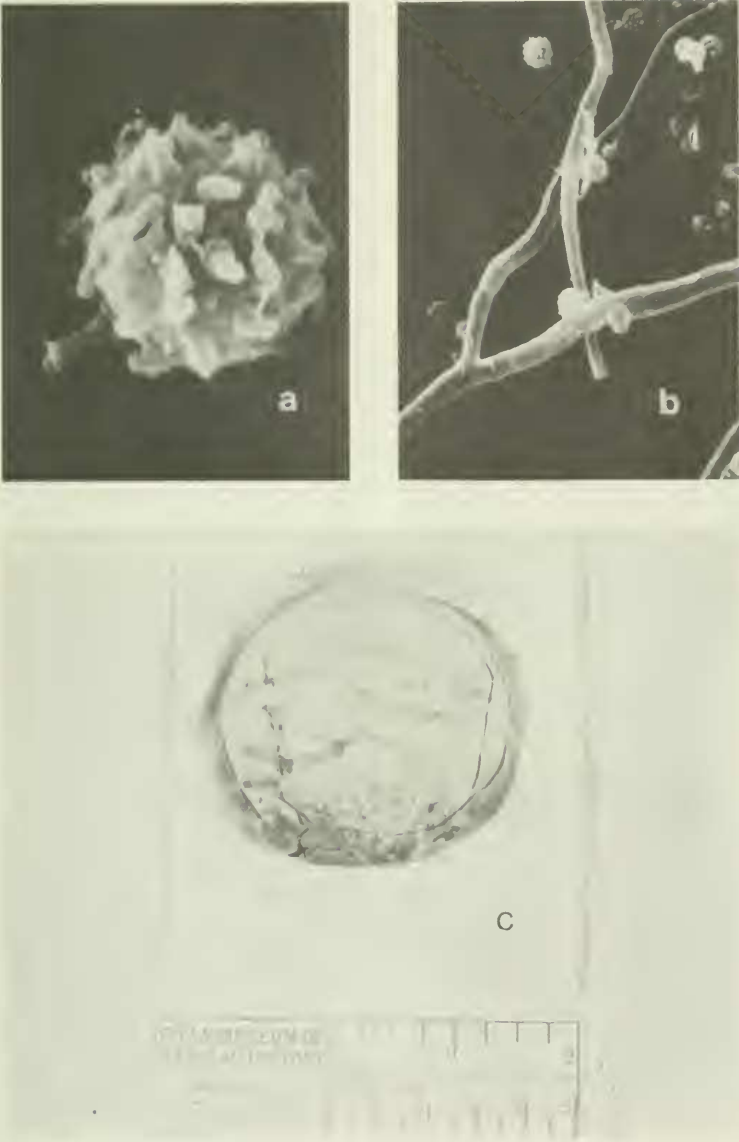


FIG.1. *Langermannia bicolor* (Polydore Roux s n, isotype K): a, spore 8,000 X. b. capillitium and spores 800 X. c, basidiocarp 3/4 natural size.

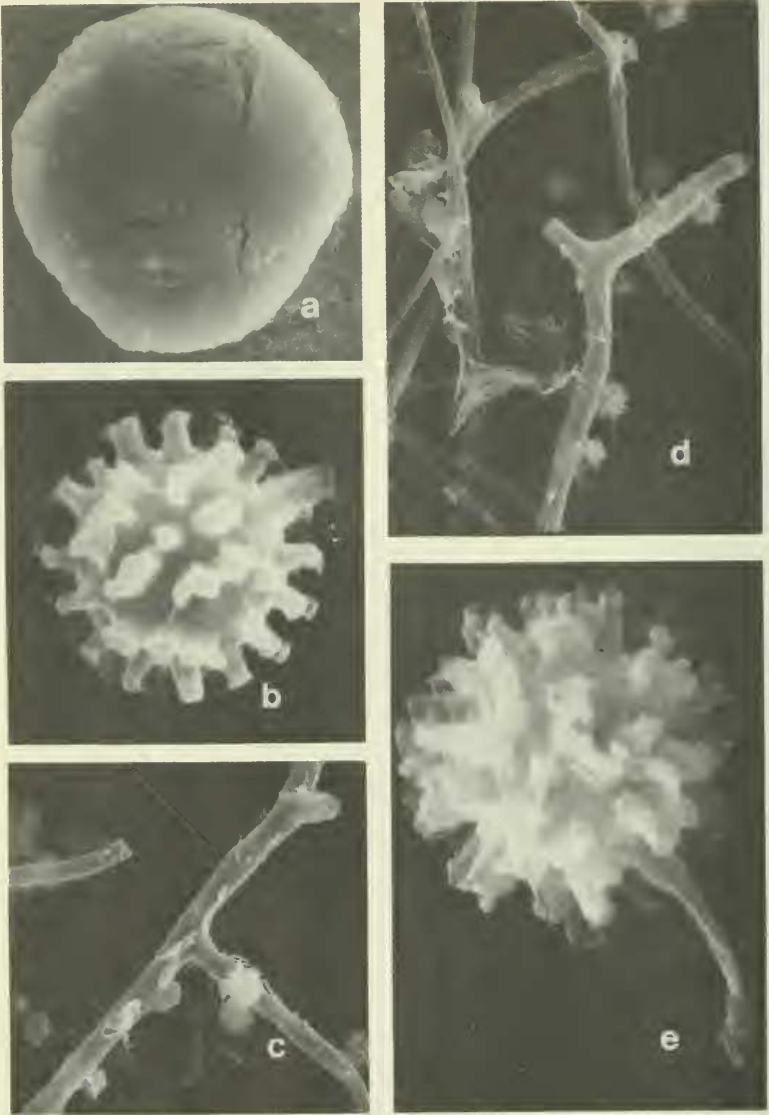


FIG.2. Langermannia bicolor, a-c (Lunt s n, Lloyd Cat. 30989 BPI): a, chlamydospore 1,800 X. b, spore 8,000 X. c, capillitium and spores 800 X. d,e (Bijl s n, Lloyd Cat. 53094 BPI): d, capillitium and spores 800 X. e, spore 8,000 x.

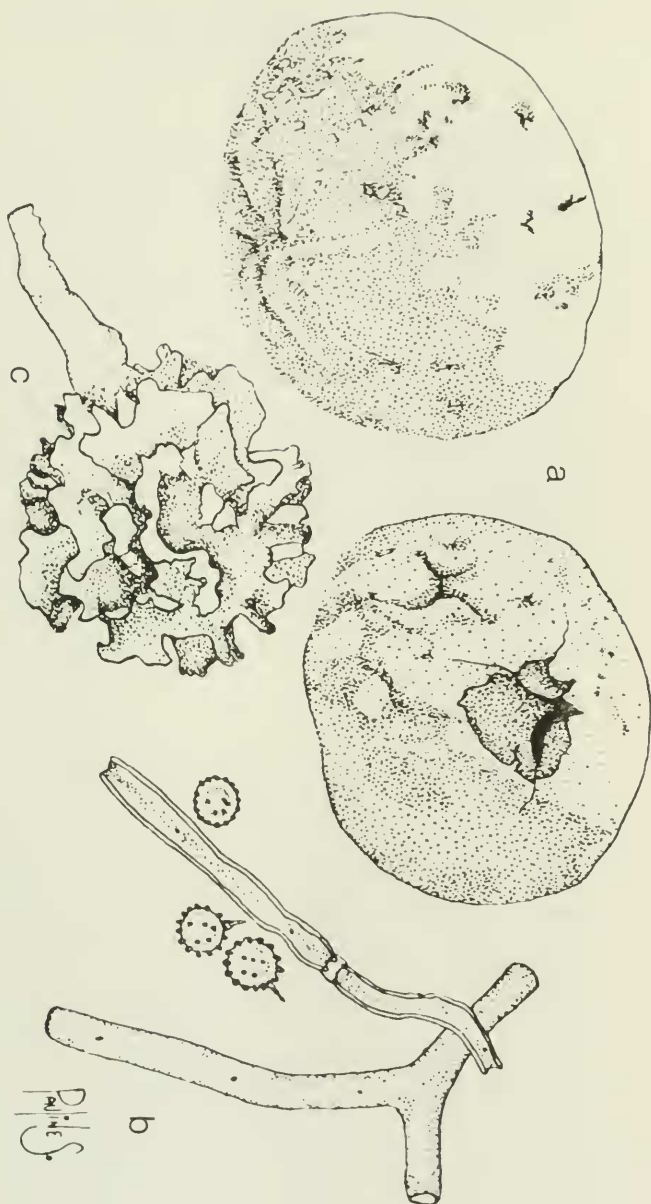


FIG. 3. *Langermannia bicolor*, a, b (Bill s n, Lloyd Cat. 53094 BPI): a, basidiocarp 3/4 natural size. b, capillitium and spores 1,000 X. c (Rick s n, Lloyd Cat. 53091 BPI): spore 8,000 X.